

STUDIES ON SOME ORIENTAL XYSTODESMINE MILLIPEDS (POLYDESMIDA, CHELODESMIDAE).

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Several years ago (1949) I published a short paper dealing with several Japanese milliped genera which were referred at that time to the family Xystodesmidae. Since then, it has been my good fortune to acquire material of exceptional interest from the Oriental region, and, in addition to treating the specimens at hand, I am taking this opportunity to present various data of systematic interest concerning some related forms.

Of perhaps greatest significance is that it is now possible to identify the genus *Xystodesmus* of O. F. Cook, and thereby to pave the way for a future consideration of the status of the family name based upon it. We have, in this instance, a case in which the characters of a family have been inferred from genera other than that designated type of the family. Although many of Cook's early milliped names were never adequately proposed, and subsequently gave rise to much confusion, as well as doubt about their status, probably none has been so vexatious as *Xystodesmus*.

Founded in 1895, the name was brought into the literature without any diagnosis, and with only the indication that *Polydesmus martensii* Peters, 1864, was the type species. The new family Xystodesmidae was created at the same time (and also without definition), including, in addition to the typical genus, *Fontaria* Gray, *Eurydesmus* Saussure, *Rhysodesmus* Cook, *Pachydesmus* Cook, and *Stenodesmus* Saussure.

Of the genera listed, *Eurydesmus* has since been transferred to another family (that which Cook knew as his Chelodesmidae). The others have been retained under the name Xystodesmidae by most American workers, and under the name Fontariidae by several of the European investigators. The original description of *P. martensii*¹ gives no characters of specific value, and no illustrations. Although Cook had seen the type specimen of *martensii* he never published what he knew about it.

Therefore, it became necessary to assume, as did Pocock in 1909, that Cook's systematic discernment was accurate enough to insure

¹ The original description, in a rather free translation, follows:

"Convex, the keels extending from about the middle of the segment and continuing the slope of the dorsum. The thickened margins of the keels are, as in other species, rounded in front and produced caudally. The pores open laterally. The first segment is almost as long as the following three combined, its caudal margin shallowly concave, and narrowed towards the ends; preanal scale rounded-triangular, with two lateral tubercles and a small terminal point. Light brownish, the keels yellow; antennae and legs white.

"Length, 24 mm; width across the metazonites, 4.3 mm; across prozonites, 3.0 mm.

"Yokuhama; Dr. von Martens, 2 males, No. 255."

that *Xystodesmus* was related within family limits to the other genera with which he associated it. Pocock wrote "The only character known to me by which the genera referred by Cook to the family Xystodesmidae can be distinguished from the genera constituting the Chelodesmidae of that author is the presence of a spine projecting from the distal end of the second segment of the legs." That character, supplemented by the compact body form, has remained until recently the main unifying feature characterizing the family.

Shortly after the recent death of Dr. Cook, a number of his effects were presented to Mr. H. F. Loomis, who discovered among them sketches of the male genitalia of the type specimen of *martensii*. Knowing of my interest in the group, Mr. Loomis very kindly sent me tracings of these drawings, and for the first time I learned the genital characteristics of the genus *Xystodesmus*. Unfortunately, the drawings were made of the gonopods *in situ*, and do not show a desirable amount of detail. Still more recently, however, Dr. Ralph Crabill sent me a milliped from Japan which is clearly a specimen of *martensii*, and the receipt of this individual makes it possible to bring the mystery of *Xystodesmus* to a satisfactory close. Although there is now considerable doubt that the family Xystodesmidae can be maintained on the basis of prefemoral spines alone, it is a matter of importance to present a generic description, based upon Peter's account of *martensii*, Cook's drawings of the type specimen, and the virtual topotype of the species which I have at hand. In 1952 I suggested the probable identity of the long-enigmatic *Fontaria*, and it is now a special pleasure to be able to dispose of the remaining genus *dubium* in this group of millipeds.

Genus *Xystodesmus* Cook

Xystodesmus Cook, 1895, Ann. N. Y. Acad. Sci. 9: 3.

Takakuwaia Verhoeff, 1936, Trans. Sapporo Nat. Hist. Soc. 14: 152 (type: *T. furculigera* Verhoeff).

Type species.—*Polydesmus martensii* Peters, 1864, by original designation.

Diagnosis.—A chelodesmoid genus with the following characteristics: composed of head and 20 segments; pore formula normal; sternites and coxae unarmed, prefemora with distal spines on legs posterior to gonopods, legs otherwise unmodified; pores lateral, in a definite peritreme; tergites smooth, moderately convex; telson triangular, its sides slightly concave; preanal scale with a conspicuous lobe on each side at the base, and with the lateral setiferous tubercles somewhat removed from the margin.

Male gonopods set in a broad, transversely oval aperture without raised margins; coxal joint of the usual form, bearing a conspicuous projecting process subtended distad by a single macroseta. Prefemoral portion straight, elongate, set with very long setae, and passing without differentiation into the femoral

² Verhoeff's illustration of the gonopod of his *furculigera* shows a suture setting off the femur, but his method of illustration does not inspire a great deal of confidence.

and tibiotarsal areas.² Femur with a thin projecting lamina on the mesial side and a slight shoulder on the lateral; tibiotarsus a simple arcuate distally tapering blade carrying the seminal groove and thus functionally a solenomerite. Prefemoral process long and slender, exceeding the tip of the tibiotarsus, unbranched but with a subterminal, mesially directed, laminate expansion.

Remarks.—Attems (1938, p. 151) observed “Den Gattungen *Rhysodesmus*, *Pachydesmus*, und *Takakuwaia* sehr ähnlich”, and on the following page stated “Eine sichere Trennung der Gattungen *Takakuwaia* und *Rhysodesmus* ist zur nicht möglich, weil die zahlreichen *Rhysodesmus*-Arten sehr ungenau beschrieben sind.” Although Attems was correct in indicating a close relationship between the last two genera named, neither bears the slightest resemblance to the enormous and very singular *Pachydesmus* of eastern United States. Of American genera, *Xystodesmus* is apparently closest to the Mexican *Cruzodesmus*, species of which were included in *Rhysodesmus* by the conservative Attems. Further consideration of the position of this genus is deferred until such time as it is possible to attempt representatives of all of the groups involved for comparative study.

***Xystodesmus martensii* (Peters)**

(Figs. 1, 2, 3, 4)

Polydesmus martensii Peters, 1864, Monatsb. Kais. Acad. Wiss. Berlin, p. 531.

Xystodesmus martensii Cook, 1895, Ann. New York Acad. Sci., 9: 3.

Takakuwaia fureuligera Verhoeff, 1936, Trans. Nat. Hist. Soc. Sapporo 14: 153, figs. 6-8.

Diagnosis.—With the characters of the genus, specifically distinctive in the configuration of the male gonopods, as illustrated (fig. 1).

Type specimen.—Male, from Yokohama, Honshu, Japan, in the collection of the Berlin Museum. Present condition unknown.

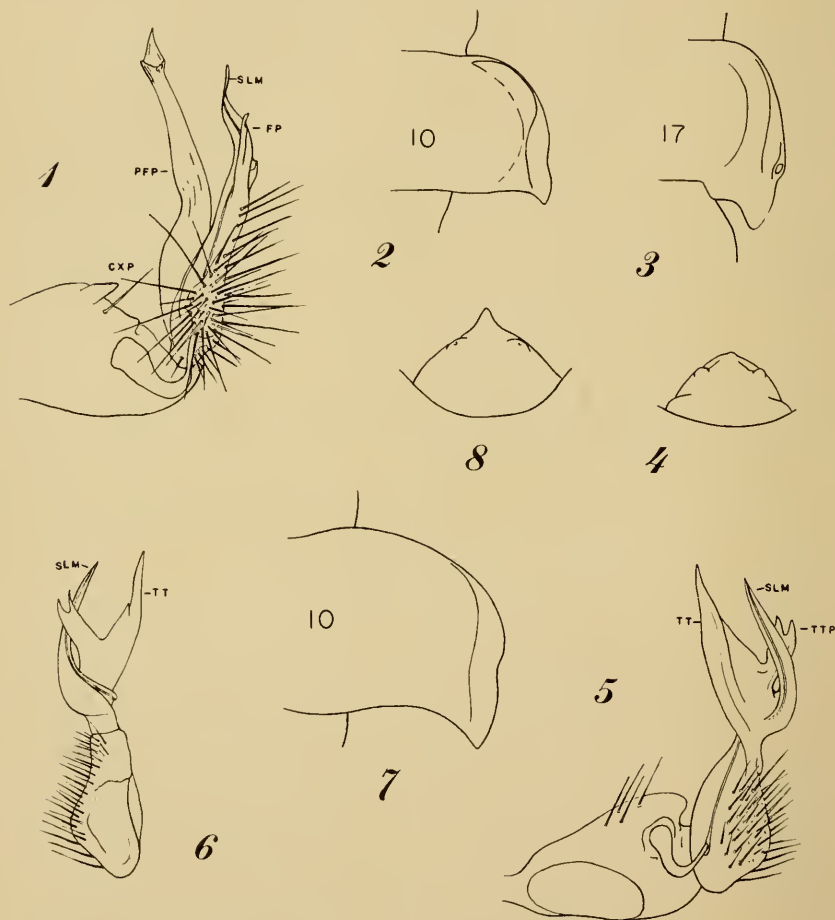
Description of species.—The following descriptive notes are made from a specimen in my personal collection (no. 6324), collected at Myanoshita, Kanagawa Prefecture, Honshu, Japan, by Theodore J. Cohn, September 24, 1953.

Adult male, 22.5 mm. long and 4 mm. in greatest width. Dorsum chiefly dilute reddish-brown, with a large oval light spot on disk of each keel, each spot areolated with light brown. Legs, underparts, and antennae pale gray to white.

Head smooth, with a distinct median vertigial groove down to level of antennae. Labrum and frons broad, the subantennal projections each with a noticeable deep transverse groove.

Collum large, smooth, its disk flattened; anterior margin evenly curved, posterior border sinuate towards ends, latter rounded, their upper surface with a small depression near front margin on each side, causing outer part of front edge to appear set off by a slight ridge. Keels of segments 2-4 rectangular, swept forward, strongly margined in front; disk of 2nd keel convex. Caudolateral corner of 5th keel slightly produced. Pores lateral in position, in a large peritreme. Tergites smooth back to the 9th segment, where a row of faint tubercles appears on the metatergite. Most tergites caudad of 9th with

a shallow transverse depression having one row of tubercles in front and two rows behind. Dorsal surface of keels swollen and rugose. Caudal corners of keels from 5th caudad increasingly produced, the caudal margin of keels straight or concave back to 16th, where a conspicuous "shoulder" appears at the base, to be repeated on the 17th segment (fig. 2) and lost again on the 18th. Peritreme of midbody segments much swollen, set off by a deep groove. Telson triangular, but with two larger-than-average terminal tubercles, and with the



Xystodesmus martensii (Peters). Fig. 1, mesial aspect of left gonopod; fig. 2, keel of 10th segment; fig. 3, keel of 17th segment, showing basal shoulder; fig. 4, preanal scale. *Kiulinga jeekeli*, n. sp., from holotype. Fig. 5, mesial aspect of left gonopod; fig. 6, sublateral aspect of telopodite of gonopod; fig. 7, keel of 10th segment; fig. 8, preanal scale. Abbreviations; *exp*, coxal process; *fp*, femoral process; *pfp*, prefemoral process; *slm*, solenomerite; *tt*, tibiotarsus; *ttp*, tibiotarsal process.

usual two lateral tubercles on each side. Preanal scale unusual in having a definite lobe at its base on each side. Underparts smooth, glabrous; sternites wide, with a median tubercle between each legpair, a low blunt tubercle at the base of each leg, and one of similar size on each coxa. Legs short and stout. Each femur caudad to 9th legpair with a long sharp spine.

Aperture of gonopods broadly oval, flush with sternite (i.e., without raised marginal rim). Sternum between 4th legpair with two high conical processes; between 6th legpair with two lower triangular processes; between 7th legs deeply excavated to receive the tips of the gonopods.

Male genitalia as described for the genus and illustrated.

Remarks.—I believe that Verhoeff's species *fureuligera*, the type of which also came from Yokohama, is a synonym of this milliped. The drawings illustrating the gonopod of his species do not preclude this likelihood, but rather confirm it. That showing the entire gonopod in mesial aspect is obviously made from the appendage in a tilted position with its distal end lower than the coxa, as the coxal projection is not shown, and more of the underside of the coxal joint is shown than in the accompanying drawing (fig. 1) of the gonopod of *martensii*. The tip of the prefemoral process as illustrated by Verhoeff is somewhat more complicated, apparently due to having been drawn from a cleared microscope preparation with an attempt to show the surface of the far as well as near side of the object. This practice was usually followed by Verhoeff, with the result of greatly complicating his drawings.

Genus *Profontaria* Verhoeff

Profontaria Verhoeff, 1941, Archiv Naturgesch., N.F. 10: 412.

Ezodesmus Takakuwa, 1942, Annot. Zool. Japonenses 21 (1): 42 (type: *E. lunatus* Takakuwa).

Type.—*Profontaria takakuwai* Verhoeff, by monotypy.

Diagnosis.—A xystodesmine genus apparently closely related to *Riukiaria*, from which it differs in lacking any trace of a prefemoral process on the male gonopod, and in the presence of a distinct subterminal branch from the tibiotarsus.

Profontaria takakuwai Verhoeff

Profontaria takakuwai Verhoeff, 1941, Arch. Naturg., N.F. 10: 412, fig. 2-4.

Ezodesmus lunatus Takakuwa, 1942, Annot. Zool. Japonenses 21: 43, fig. 7;

Chamberlin and Wang, 1952, Amer. Mus. Nov. 1621: 7.

The figures given with the original descriptions by Verhoeff and Takakuwa leave no doubt that both names are based upon the same species. This is corroborated by the fact that the type specimens of both came from the same place—Sapporo, Hokkaido. Verhoeff's name is the older by about five months.

Genus *Japonaria* Verhoeff

Japonaria Verhoeff, 1936, Trans. Sapporo Nat. Hist. Soc. 15: 155 (as subgenus of *Fontaria*); Attems, 1938, Das Tierreich 69: 174; Takakuwa, 1942, Annot. Zool. Japonenses 21: 39; Hoffman, 1949, Chicago Acad. Sci. Nat. Hist. Misc., No. 45, p. 5.

Parafontaria Verhoeff, 1936, Zool. Anz. 115: 301 (type: *P. armigera* Verhoeff, by monotypy).

Grayaria Chamberlin, 1943, Bull. Univ. Utah, Biol. Ser., 8 (2): 16 (type: *G. attensi* Chamberlin [= *Fontaria coarctata acutidens* Attems 1909 = *Japonaria circula acutidens* (Attems)]), by original designation.

Type.—*Japonaria falcifera* Verhoeff 1936, by subsequent designation of Attems, 1938.

Diagnosis.—Xystodesmines with both coxae and prefemora spined; sterna unarmed; pore formula normal, pores opening laterally; tergites smooth, moderately arched; posterior corners of keels rounded off except on the last 3 to 7 body segments where somewhat produced caudally. Male gonopods large, without any trace of coxal, prefemoral, or femoral processes; prefemur small and subglobose; femur nearly straight or slightly curved distad, set off from the tibiotarsus by a more or less perceptible joint; tibiotarsus forming somewhat more than a complete circle, distally enlarged and elaborated into a variable number of processes, of which one is a solenomerite.

Remarks.—The species of this genus have been the victims of some very careless work, chiefly at the hands of Verhoeff. When I expressed my belief (1949, *op. cit.*) that the subgenus *Parafontaria* was untenable, I was unaware that Takakuwa had previously published the same conclusion, based on first-hand experience with the animals involved.

In his very useful paper cited above, Takakuwa did a great deal to clear up the existing confusion. First, he pointed out that there is no real generic difference between *Japonaria* and *Parafontaria*. Second, he showed that, contrary to Verhoeff's original description, the gonopods of *J. attensi* are *not* nearly straight³ and provided a sketch of their true appearance. Third, he discussed inaccuracies in the descriptions of the genitalia of *J. acutidens* and *J. spiraligera*. Fourth, he came to the conclusion that *J. kuhlgatzi* is a strict synonym of *J. laminata*, and that *J. armigera* is only subspecifically distinct from it. With all of these observations I am in complete accord.

It is now necessary to see how these modifications affect the only existing complete account of the genus, that of Attems in Lief. 69 of *Das Tierreich*. Attems recognized two subgenera, *Japonaria* and *Parafontaria*, the latter now being consigned to synonymy and its type species regarded as subspecifically related to *Japonaria laminata*. Attems listed eight species in *Japonaria*, and provided a key, which

³ It is curious that Verhoeff apparently never realized that boiling of gonopods in caustic tended to straighten normally curved structures. Several of his species were founded upon material distorted in this manner.

must be entirely rewritten to correct the misconcepts based upon faulty descriptions and to accommodate new species recently described by Takakuwa and Verhoeff. Since the existing descriptions and illustrations leave much to be desired, the construction of such a key from information in the literature would be difficult and of dubious value. As I have but a few species represented by material, the best I can do at this time is to provide a list of the named forms which appear to be valid. These number 13, of which 8 are regarded as full species with 3 having several subspecies.

1. *J. coarctata coarctata* (Pocock) 1894, Ann. & Mag. Nat. Hist. (6) 15: 361, fig. 11.
2. *J. coarctata attensi* Verhoeff 1938, Trans. Nat. Hist. Soc. Sapporo 14: 159, figs. 9, 10.
3. *J. circula circula* (Attems) 1901, Mitt. Mus. Hamburg 18: 97, pl. I, figs. 5-7.
4. *J. circula acutidens* (Attems) 1909, Ark. Zool. 5(3): 30, pl. I, fig. 13.
5. *J. circula marmorata* Verhoeff 1937, Zool. Anz. 117: 316, fig. 7.
6. *J. aculeata* Verhoeff 1941, Zool. Anz. 136: 68, figs. 3, 4.
7. *J. erythrosoma* Takakuwa 1942, Annot. Zool. Japon, 21: 40, fig. 3.
8. *J. terminalis* Takakuwa 1942, Annot. Zool. Japon. 21: 39, figs. 1, 2.
9. *J. spiraligera* Verhoeff 1937, Zool. Anz. 117: 315, figs. 3-6.
10. *J. falcifera* Verhoeff 1936, Trans. Nat. Hist. Soc. Sapporo 14: 157, pl. 3, fig. 11.
11. *J. laminata laminata* (Attems) 1909, Ark. Zool. 5 (3): 29, pl. I, figs. 14, 15.
12. *J. laminata armigera* Verhoeff 1936, Zool. Anz. 115: 301, figs. 4-6.
13. *J. laminata montana* Verhoeff, 1941, Zool. Anz. 136: 63, figs. 1, 2, 5, 6.

Kiulinga, new genus

Type.—*K. jeckeli*, n. sp., by present designation.

Diagnosis.—A genus of small xystodesmines with the following characteristics: composed of head and 20 segments, pore formula normal, pores opening lateral or ventrolateral; tergites completely smooth; caudal margins of keels from 4th segment caudad distinctly concave; preanal scale large, with a prominent terminal projection; sternites wide, smooth, not produced at bases of legs; coxae unarmed, prefemora with the usual acute distoventral spine.

Male gonopods set in a broad, transversely oval aperture the caudal edge of which is raised into a distinct flange; coxal joint without special modification; prefemoral portion enlarged, flattened, setose, without trace of prefemoral process; femur greatly reduced; tibiotarsus twisted about 180° around the main axis of the telopodite, the seminal groove thus nearly encircling the gonopod before proceeding upon the long slender solenomerite; tibiotarsus expanded into a broad lamellate blade, with an accessory projection near the base.

Range.—Central eastern China.

Species.—Two.

Kiulinga jeekeli,⁴ new species

(Figs. 5, 6, 7, 8)

Diagnosis.—Separable from *K. lacustris* (Pocock) in lacking long setae on the sternites, and in that the basal tibiotarsal process is distally bifid.

Type specimen.—Adult male, U. S. Nat. Mus., from the Hangkow River Gorge, Kuling (near Kiukiang), Hupeh Province, China; collected by O. F. Cook and H. F. Loomis on October 18, 1919.

Description of type.—Adult male, 20 mm. long and 4.5 mm. wide. Completely bleached from long preservation.

Head smooth, shining, without special modification. Four long frontal setae. Clypeal groove distinct. Antennae long and slender, attaining 4th segment when laid back; articles increasing in length up to 6th, clothed from 3rd on with numerous long setae; 4 terminal sensory cones; antennae separated at base by a distance about equal to length of 6th article (ca. 0.70 mm.).

Collum rather large, longer than 2nd and 3rd tergites at midline; front margin continuously curved, posterior margin swept forward slightly, ends rounded; front margin with weakly defined submarginal grooves.

Tergites moderately arched, keels continuing slope of dorsum, smooth and shining; interzonal furrow very distinct. Caudal margins of keels of segments 2 and 3 swept forward, those of succeeding segments concave (fig. 7); the anterior corners of all keels broadly and evenly rounded and strongly margined; peritremata moderately broad in dorsal aspect and fairly well set off; pores lateral, becoming definitely sublateral on the caudalmost segments; pore distribution normal. Caudolateral corners of keels becoming increasingly produced back to 19th segment. Telson subtriangular, with several low transverse ridges. Caudal margin of 17th keel forming a very slight shoulder at base, similar to that figured for *martensii* but very much smaller.

Anal valves nearly flat and smooth, with very prominent compressed marginal ridges. Preanal scale relatively large, subtriangular with convex edges, terminal projection very prominent (fig. 8).

Pleural areas finely granular but without special tubercles or crests. Sternites wide, glabrous, the area between legs but slightly raised above level of prozonite, coxae of midbody legs about 1.0 mm. apart.

Legs short and robust, coxae with numerous long setae on the ventral side; prefemora much less hairy, with a sharp ventrodistal spine; femur and post-femur almost glabrous; tibia becoming setose distally; tarsus densely clothed with long bristle-like setae. Lengths of joints of midbody leg, from coxa distad: .34—.45—.90—.40—.38—.35 mm., total, about 2.80 mm. (exclusive of tarsal claw).

Sterna between 3rd and 4th legpairs each with two low transverse elevations. Anterior legs somewhat shorter and more setose than those farther back. Tarsal claws short, evenly curved.

Gonopod aperture large, oval, wider than intercoxal space of 7th segment, its caudal margin produced into a distinct thin flange. Gonopods as characterized for the genus and illustrated by figures 5 and 6.

⁴ Named for my friend and colleague, C. A. W. Jeekel, of the Zoologische Museum, Amsterdam, a specialist on Indo-australian diplopods.

Kiulinga lacustris (Pocock)

Fontaria lacustris Pocock, 1895, Ann. & Mag. Nat. Hist. 6, 15: 359; pl. 11, fig. 8.

Diagnosis.—Differing from *jeckeli* in that the sternites are setose, and the tibiotarsal process of the gonopod is unbranched and much more slender.

Type specimen.—Male, from Wo-Lee Lake, 25 miles south of Ningpo (now Ninghsien), Chekiang Province, China; in the collection of the British Museum (Natural History).

Description.—Pocock's original description is quoted in its entirety:

"Colour (?faded) pale yellowish white throughout.

Terga smooth, laterally above the keels lightly wrinkled or coriaceous; keels rather large, the anterior angle rounded, the posterior rectangular or acute, but not dentiform; the anterior edge of the keel with a small basal shoulder, the posterior edge emarginate, with a larger basal shoulder.

Sterna and *coxae* of the legs studded with long hairs. Anal sternite furnished with a medianly backward projecting spiniform process.

Copulatory feet diverging externally from the base, each terminating in two processes—the interior [solenomerite] simple, pointed, curved like an S, the superior [tibiotarsus] inwardly directed, bifid.

Length 20 millim.; width across keels 3.5, width across cylindrical part of segment 2.5."

Both the foregoing description and its accompanying figures agree so well with the type specimen of *jeckeli* that I have no doubt that the two are congeneric. The major points of difference between them are the presence of hairs on the sternites of *lacustris* and the bifurcate tibiotarsal process of the gonopod in *jeckeli*. The characters of the gonopods and the preanal scale are particularly indicative of close relationship.

The number of dubious Asiatic species of xystodesmines is now reduced to a very few, most of which were described in the last century from type specimens now lost or inaccessible. One genus remains enigmatic, *Cyphonaria* Verhoeff, the type species of which was based on a female specimen.

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A NEW PARASITE RECORD FOR THE LIMA BEAN POD BORER IN CALIFORNIA

(LEPIDOPTERA, PYRALIDAE)

A sample of lima beans grown in Ventura County, California, in 1954 was sent to the author in November, 1955, for diagnosis of an insect infestation. From dead larval remains, frass and feeding damage it was determined that the lima bean pod borer, *Etiella zinckenella* (Treit.), had been responsible for the damage. Several hundred beans were split and examined carefully. Three female and one male bethylid parasites were discovered, with two of the females being still alive. All were found between the bean cotyledons in association with pod borer frass and damage. Several of the bethylid cocoons were found embedded in the pod borer frass. This evidence appears presumptive that the bethylids had parasitized the pod borer larvae. The parasites were determined by Howard Evans as *Cephalonomia galli-cola* (Ashmead) (Hymenoptera, Bethyridae). Muesebeck and Walkley (1951, *In* Hymenoptera of America North of Mexico, U. S. Department of Agriculture, Agriculture Monograph No. 2, p. 727. list the known distribution as "probably almost cosmopolitan" with specific localities in the United States along the eastern seaboard and west to Nebraska. It is interesting to note that they record it from two species of Coleoptera, the drugstore beetle, *Stegobium paniceum* (L.), and the cigarette beetle, *Lasioderma serricorne* (F.), as well as from the gall of a cynipid, *Andricus foliatus* Ashm.

The females and one male have been placed in the California Insect Survey collection of the University of California, Berkeley.—WOODROW W. MIDDLEKAUFF, *University of California, Berkeley.*